Product Information

CG1-RADIO *CompactPCI* ® Global Positioning System (GPS) Receiver

Document No. 2020 • Edition 04/2002

Both, the global time (UTC) and the geographic position, provides the CompactPCI® based GPS receiver board ***CG1-RADIO*** *manufactured by EKF.*

Most industrial computer systems need synchronization to a precise time standard. A solution to this problem would be any radio controlled clock. Unfortunately, most countries have their own local transmitter standards (if any). Hence, for universal use (e.g. if systems are mobile or destined for export), a GPS based clock is the best choice.

The **G**lobal **P**ositioning **S**ystem provides the **U**niversal **T**ime (**C**oordinated) and - of course - position data. Most useful for mobile applications, also country specific program versions could be executed automatically. A CG1-RADIO equipped system can signal its current position to a remote computer.

The CG1-RADIO module is housed on a single size Eurocard (3U). The board is provided with a high performance 12 parallel-channel receiver engine continuously tracking all satellites in view, thus providing accurate positioning and time data. The receiver is compatible with passive or active antennas and supports the NMEA-0183 data protocol.

Direct, differential RTCM SC-104 data capability dramatically improves the positioning accuracy. For that, the CG1-RADIO is equipped with a serial port for communication with an external DGPS receiver.

From the hosts view, the enclosed drivers reduce the CG1-RADIO board to one or two common serial ports, e.g. COM3/4. Therefore most programs based on the NMEA-0183 data protocol can be executed without modification.

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The highly integrated digital GPS receiver uses the Zodiac chip set (Rockwell/Conexant) and is accommodated on a miniature daughter board as an exchangeable sub-assembly. The 12-channel architecture provides rapid Time-To-First-Fix (TTFF) under all startup conditions. The receiver decodes and processes signals from all visible GPS satellites, thereby producing a highly accurate and robust navigation solution. The external GPS antenna connects to the front panel mounted SMB style jack and must have reasonable visibility of the sky. For best performance, use an active antenna, especially for a cable length of 3m and above.

Due to Selective Availability (SA) the GPS navigation accuracy is limited to 100m for civil use. The CG1-RADIO however as an option allows to read in an external differential signal (DGPS) in order to reduce the positioning error to 3-5m. For this, the CG1 is provided with a 9-pin D-SUB connector (front panel) serial interface port. Incoming DGPS data must conform to the international RTCM SC-104 protocol. The type of the external DGPS receiver depends on the location. In Germany e.g. there is a choice between the LW ALF transmitter (Mainflingen, Deutsche Telekom) or the RASANT FM RDS System (ARD).

Equipped with the powerful embedded processor i960RP(D), the board profits from the built-in PCI bridge as interface to the *CompactPCI®* system bus. For typical applications, the EKF software drivers let the CPCI system host view the CG1-RADIO module as 16C550 UART based dual serial adapter card. Available by download, the EKF utility WinGPS displays the GPS data and allows for synchronization of the system clock to the UTC.

The first serial port of the CG1-RADIO is for on-board use only. It serves as a communications interface to the GPS receiver. Commands and data can be sent to and received from the GPS daughter board according to the NMEA-0183 standard protocol. The moderate transmission rate of 4800bps cares for low interrupt load of the system host.

The second serial port is intended either as external DGPS interface (read only), or as a general purpose RS-232E communications channel. The wiring of the front panel mounted 9-pin male D-SUB connector SP2 is identical to desktop PC COM ports. When receiving differential DGPS data at 9600bps according to the RTCM SC-104 standard, the GPS daughter module uses this information for its internal calculations to sharpen the positioning data. The second serial interface is also directly readable by the system host. Programs as LabMon (Rockwell/Conexant) need DGPS data in parallel to the GPS receiver for presentation.

If the DGPS data capability of the CG1-RADIO is not used, then the serial port SP2 is available for general purpose I/O applications.

The EKF drivers treat the CG1-RADIO module as 16C550 compatible COM ports. While the drivers allow arbitrary names e.g. COM11, practically there exist limitations in most systems. Typically, COM1 and COM2 are reserved names for the host CPU's serial interfaces. On the other hand, most GPS and communications applications will support COM1..4 only. Therefore COM3 is recommended to control the GPS NMEA port (first serial interface of the CG1-RADIO), and COM4 to be used as DGPS RTCM receiver (second serial port, SP2).

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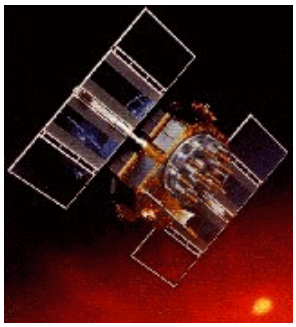
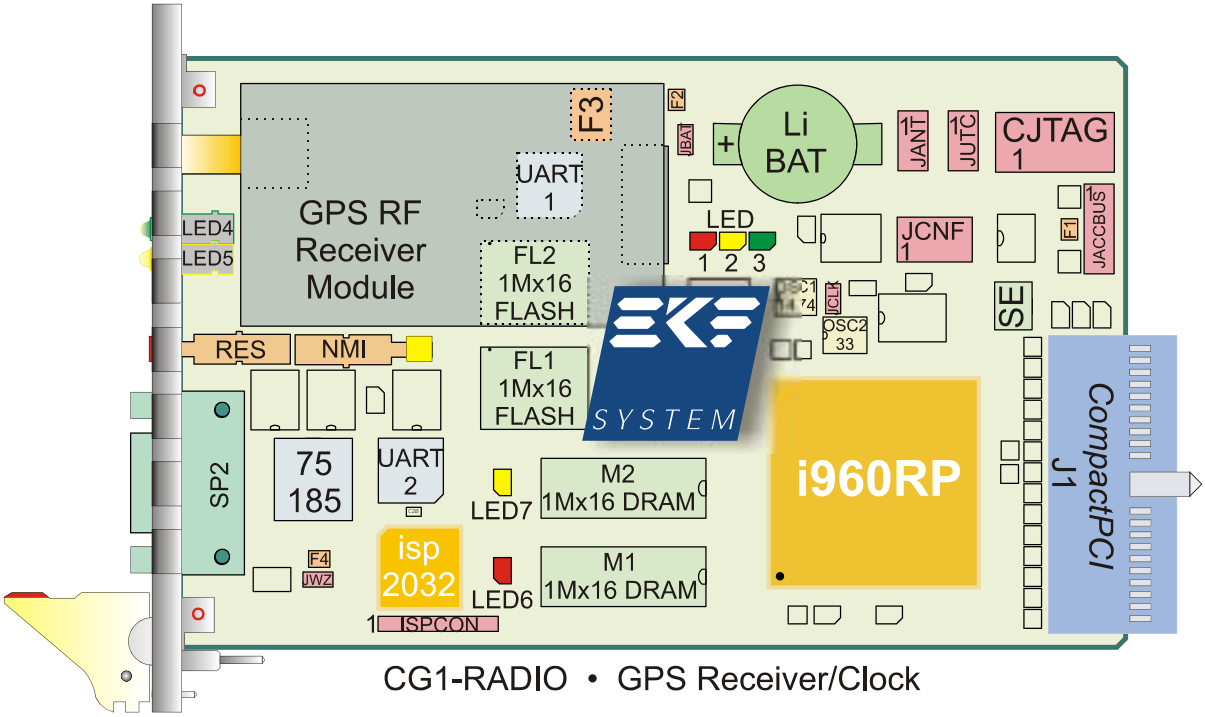
There are many commercial GPS application programs available, often allowing cartographical visualization. In addition, the Internet is full of GPS shareware tools. The common basis of most applications is the NMEA-0183 protocol, so that they should be usable with the CG1-RADIO without any modification.

Developers might prefer to sample and compute GPS data locally on the CG1 board. This can be achieved by the local i960 processor. Program and data can be stored in a generous amount of local memory (4MB DRAM and 4MB Flash EEPROM). As a development tool, EKF provides the resident monitor/debugger MON960, which allows stand-alone operation and download of programs via CPCI bus or serial interface SP2. Furthermore EKF can offer turn key ready application programming support.

he CG1-RADIO module lends full GPS functionality to any industrial *CompactPCI®* system. Beginning with applications needing absolute time stamps or isochronous control of tasks, up to programs requiring three-dimensional navigation, the CG1-RADIO board is the perfect and affordable choice wherever GPS can solve a problem.





CG1-RADIO • GPS Receiver/Clock

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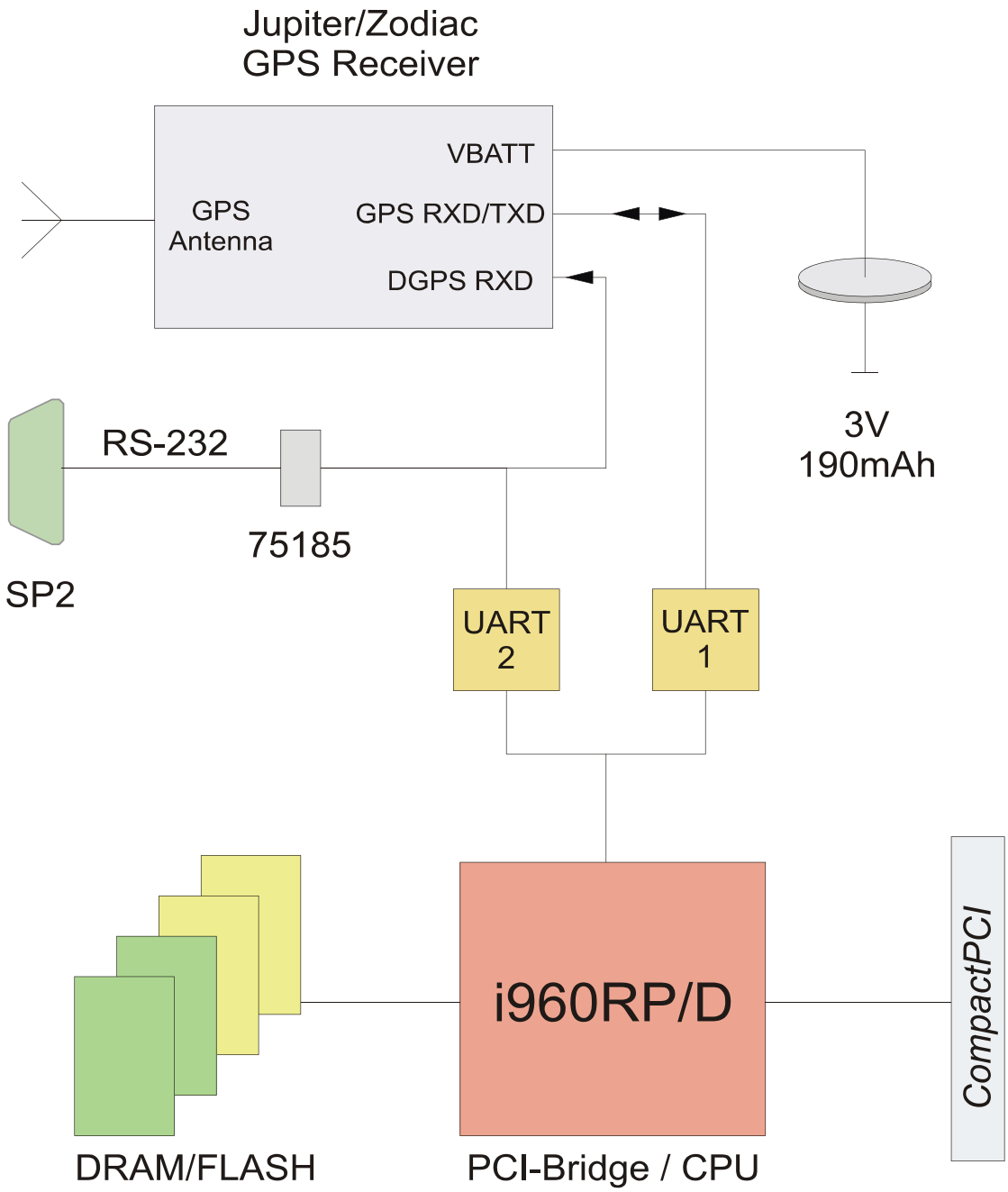
CG1-RADIO Block Diagram



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Technical Specifications		
Printed Circuit Board	**Dimensions**	3U Eurocard (100x160mm^2), front panel width 20.3mm (4HP), mechanics constructed with respect to EMC requirements, ejector lever
CPU	**Microprocessor**	Intel i960RP/RD, 3.3V, 33/66MHz, clocked by system bus (local oscillator provided when operated as stand-alone)
	Memory	4MBytes FPM/EDO DRAM, 32-bit, 4MBytes FLASH ROM (SMT) 28F160S5 (Intel, Sharp), 32-bit
	Utilities	Watchdog and 5V/3.3V voltage-supervisor MAX705, serial EEPROM 4KByte I^{2}C, optional: ACCESS.bus interface
	Firmware	Mon960 Monitor/Debugger
Serial Interfaces SP1 (internally) and SP2 (externally and internally)	**Protocol**	Asynchronous, serial protocol: 1 startbit; 7 or 8 databits; 1 or 2 stopbits; optional even/odd parity; standard bitrates up to 115,2 kbps, default parameters for GPS operation SP1=4800Baud (GPS NMEA-0183), SP2=9600Baud (DGPS RTCM SC-104)
	Serial Interface Controller	2 x 16C550 asynchronous communication element, e.g. Texas Instruments TL16C550C or equivalent
	Physical Interface SP2	RS-232E/V.28, PC compatible D-SUB connector male 9-pin, to be used either as DGPS input or as universal serial COM port, ESD protection 10kV, pin 9 configurable either as RS-232 RI input or +12V power supply output to external DGPS receiver (PolySwitch resettable fuse 100mA)
	Drivers	Serial drivers (COM port emulation) available for Windows NT4.0 and Windows 2000, others forthcoming
GPS	**Receiver Module**	Exchangeable modular 12-channel receiver, chip set Conexant (Rockwell) Zodiac, SMB jack for 1575,42MHz (L1 Band) GPS antenna active or passive, RF signal level at 130dBW ... -163dBW, antenna supply 0V, +5V, +12V selectable with jumper JANT (PolySwitch resettable fuse 100mA)
	Data Retention Warmstart	Keep-Alive power condition for enhanced TTFF upon power-up (Time To First Fix), SRAM and RTC data non-volatile buffered by Lithium cell 190mAh (>4500h)
	Software	NMEA protocol based application programs
CompactPCI® **Bus**	**Connector J1**	32-bit, 33MHz (133MB/s) 32-bit DMA bus master (133MB/s) PCI burst mode 5V interface
Power Supply	**Connector J1**	+5V ±5% 0.5A max. +3.3V ±0,3V 0.7A (i960RP) 0.9A (i960RD) max. +12V ±5% 0.1A max. -12V ±5% 0.1A max.
Temperature Humidity	**Operating**	operating temperature 0-70°C humidity 5-90% non condensing

specifications are subject to change without further notice

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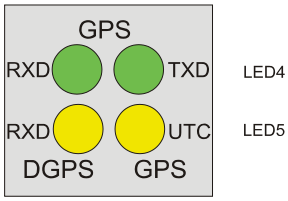
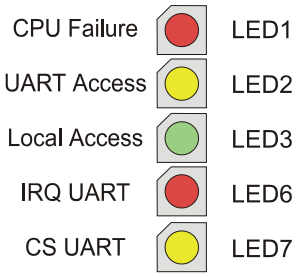
CG1-RADIO
LED Beschriftung Frontplatte



CG1-RADIO
On-Board SMT LEDs



Jumper Configuration Fields	
JANT	Antenna passive, antenna active +5V, antenna active +12V
JBAT	Lithium battery for data retention of GPS module's RTC and SRAM
JCLK	CPU clock derived locally or from CPCI bus
JCNF	CPU behaviour after reset, effects of CPCI reset on CG1-RADIO
JWZ	Serial port SP2 D-SUB pin 9, configured either as RS-232 RI input or +12V output as power supply to external WZ DGPS receiver

External Connectors (Front Panel)	
ANT	RF input 1575,42MHz (L1 band), GPS antenna active or passive, input signal level at -130dBW ... -163dBW, SMB jack, power supply voltages selectable 0V, +5V, +12V (jumper JANT), PolySwitch resettable fuse 100mA
SP2	RS-232E D-SUB 9 male connector, can be used either as universal serial COM-port (standard bitrates up to max. 115,2 kBaud), or as DGPS input (according to RTCM SC-104 protocol, 9600bps, 8bit, 1 startbit, 1 stopbit, no parity)

Internal Headers (Option)	
CJTAG	JTAG testport
ISPCON	ispGAL programming port
JACCBUS	I^2C-Bus expansion interface
JUTC	TTL time mark pulse 1Hz and 10kHz, synchronized to the UTC Universal Time (Coordinated)

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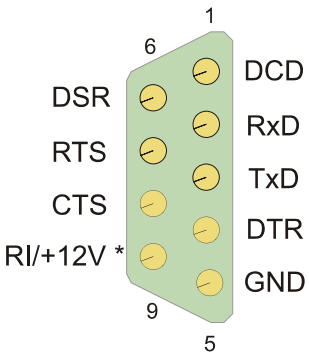
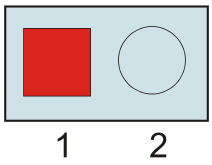


CG1-RADIO
SP2 (RS-232E)
male D-SUB

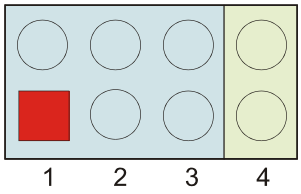
* function depends on Jumper JWZ settings
JWZ = off RS-232 RI (input)
JWZ = set +12V DGPS power (output)

JWZ



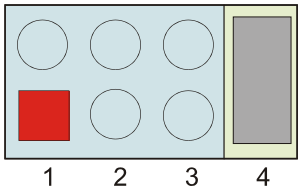
JWZ determines function of SP2 pin 9
jumper off = RS-232 RI input (default)
jumper set = +12V/50mA power output

JCNF



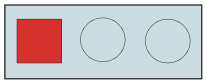
i960 configuration
(behaviour after reset)

CPCI
RES
passed

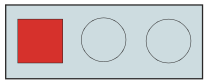


JCNF default configuration:
(1) local CPU starts after CPCI reset
(2) retry CPCI config cycles
(3) no internal CPU selftest after CPCI reset
(4) CPCI reset passed through to local reset

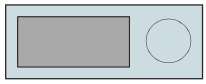
JANT



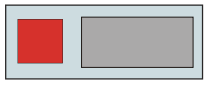
1 +5V
2 Antenna PreAmp Power
3 +12V



passive antenna (default)



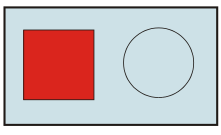
active antenna +5V



active antenna +12V

WARNING: unmatched JANT settings may destroy antenna
check setting anytime before connecting GPS antenna

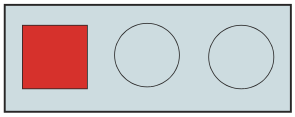
JBAT



JBAT provides for non-volatile
GPS RTC & SRAM data
jumper off - saves cell lifetime while board storage
jumper set - data retention mode

factory default is off -
check setting if TTFF is slow

JUTC



1 TMARK (1s)
2 GND
3 10kHz

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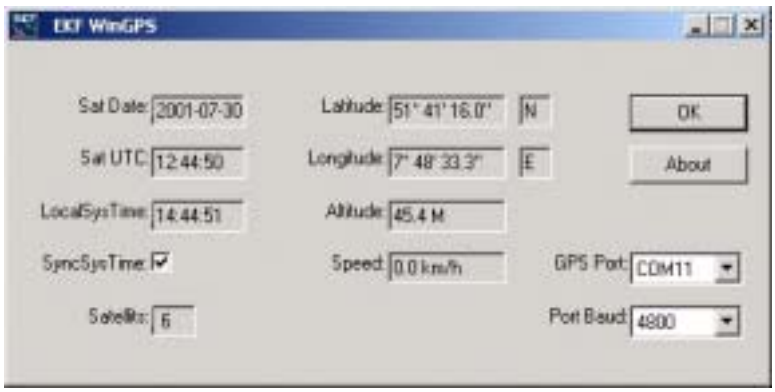

EKF WinGPS
Tool for GPS Data Display
and Synchronization of System Time

Ordering Information		
Alias	Ordering No.	Short Description
RADIO	CG1-1-RADIO	3U *CompactPCI* hostadapter, 12-channel GPS receiver subsystem with i960RP CPU/bridge, 4MB Flash, 4MB DRAM
	CR9-1-ADAPT	Front panel expansion kit 3U –> 6U
	940.80.20125.1	GPS antenna, active +5V, SMB connector, ~5m cable length
	940.80.90100.1	External DGPS LW receiver box, including ALF license (Accurate Positioning by Low Frequency, transmitter Mainflingen/Frankfurt, receiver radius about 650km), not required while deactivation of GPS SA function

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